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(54) **PREDICTIVE PAGE LOADING BASED ON TEXT ENTRY AND SEARCH TERM SUGGESTIONS**

(75) Inventors: **Blair L. Hotchkies**, Bellevue, WA (US); **Michael L. Brundage**, Kirkland, WA (US); **Pongsakorn Teeraparpwong**, Bellevue, WA (US); **Jason P. Patrikios**, Seattle, WA (US); **Sarah E. Williams**, Seattle, WA (US); **Brent Robert Mills**, Seattle, WA (US); **Alexandru I. Indrei**, Seattle, WA (US); **Daniel R. Parshall**, Redmond, WA (US); **John M. Nilles**, Poulsbo, WA (US); **Sikandar Saifullah**, Issaquah, WA (US)

(73) Assignee: **AMAZON TECHNOLOGIES, INC.**, Seattle, WA (US)

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G06F 17/30 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 17/30867*** (2013.01); *G06F 17/30902* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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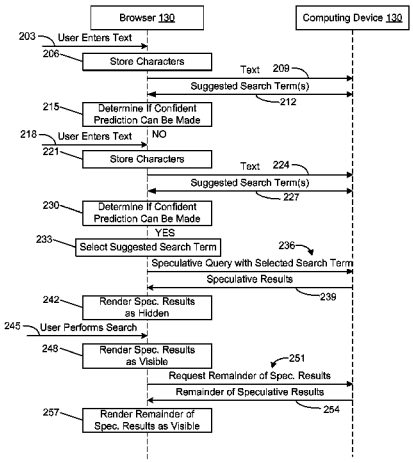
Primary Examiner — Charles Adams
(74) *Attorney, Agent, or Firm* — Thomas | Horstemeyer, LLP

(57) **ABSTRACT**

Disclosed are various embodiments for predictive page loading. Text entered by a user into a search query form is captured. If an evaluation of the size of the captured text or identity of characters in the captured text in accordance with a confidence criteria indicates that the confidence criteria is met, a speculative search query is provided to a server. The speculative search query includes a selected suggested search term. A received plurality of speculative search results is rendered in a hidden portion of a browser window. In response to receiving a user instruction to execute a committed search query that includes the at least one selected suggested search term, at least a portion of the received plurality of speculative search results is rendered in a visible portion of the browser window.

20 Claims, 11 Drawing Sheets



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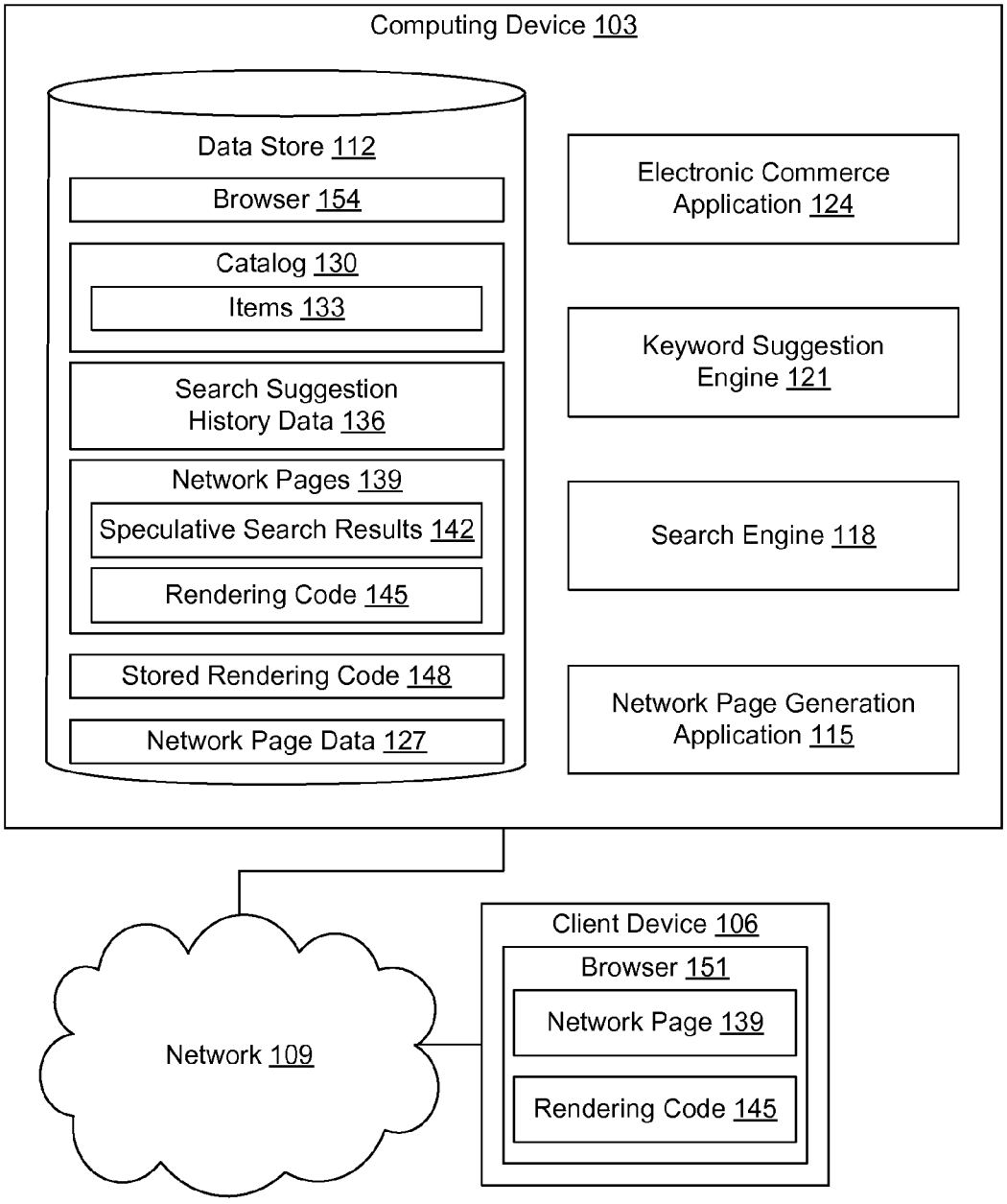
Computing Device 103
Data Store 112
Browser 154
Catalog 130
Items 133
Search Suggestion History Data 136
Network Pages 139
Speculative Search Results 142
Rendering Code 145
Stored Rendering Code 148
Network Page Data 127
Electronic Commerce Application 124
Keyword Suggestion Engine 121
Search Engine 118
Network Page Generation Application 115
Network 109
Client Device 106
Browser 151
Network Page 139
Rendering Code 145

FIG. 1

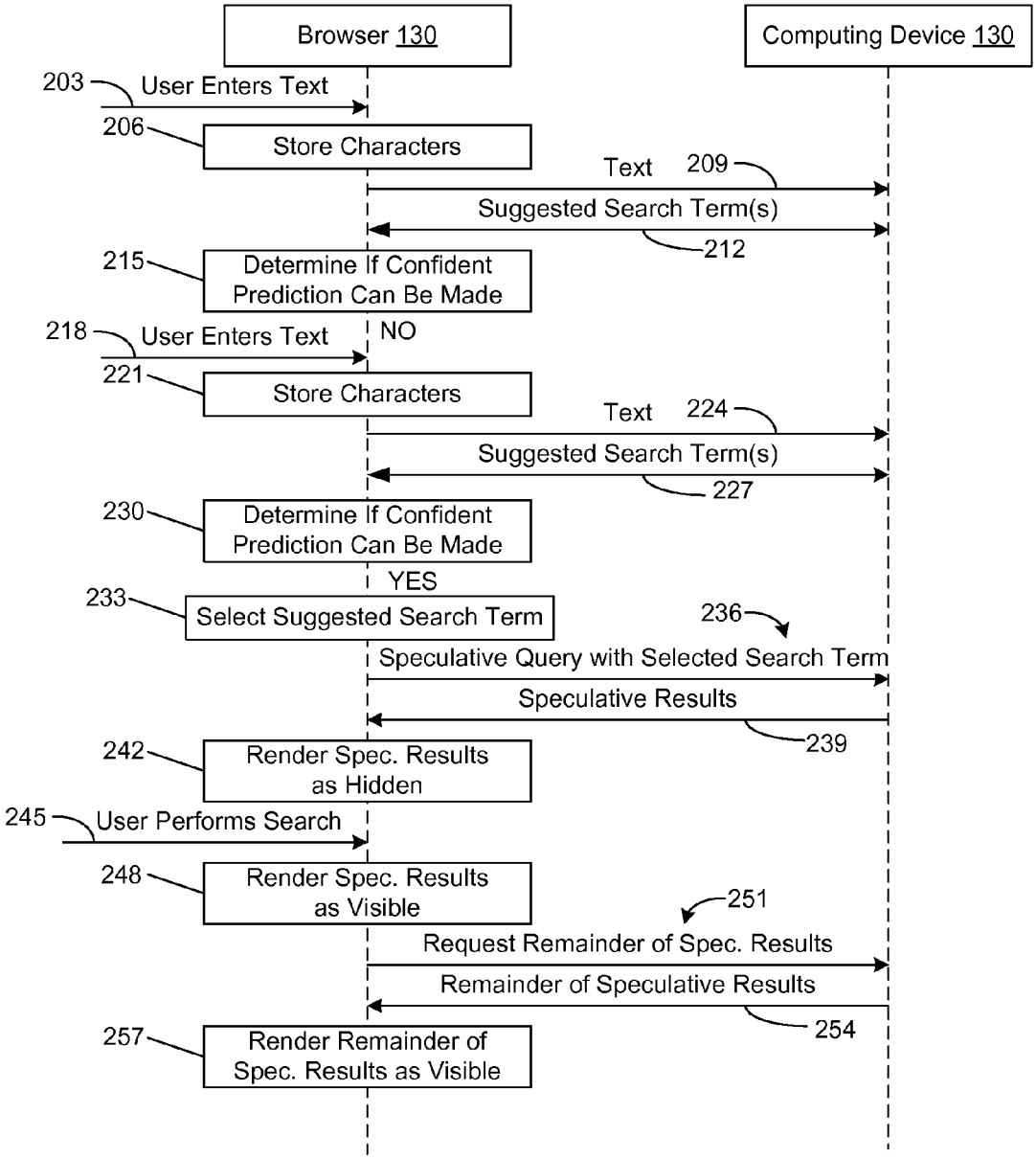
Browser 130
Computing Device 130
203
User Enters Text
206
Store Characters
Text
209
Suggested Search Term(s)
212
215
Determine If Confident Prediction Can Be Made
218
User Enters Text
NO
221
Store Characters
Text
224
Suggested Search Term(s)
227
230
Determine If Confident Prediction Can Be Made
YES
233
Select Suggested Search Term
236
Speculative Query with Selected Search Term
Speculative Results
239
242
Render Spec. Results as Hidden
245
User Performs Search
248
Render Spec. Results as Visible
251
Request Remainder of Spec. Results
Remainder of Speculative Results
254
257
Render Remainder of Spec. Results as Visible

FIG. 2

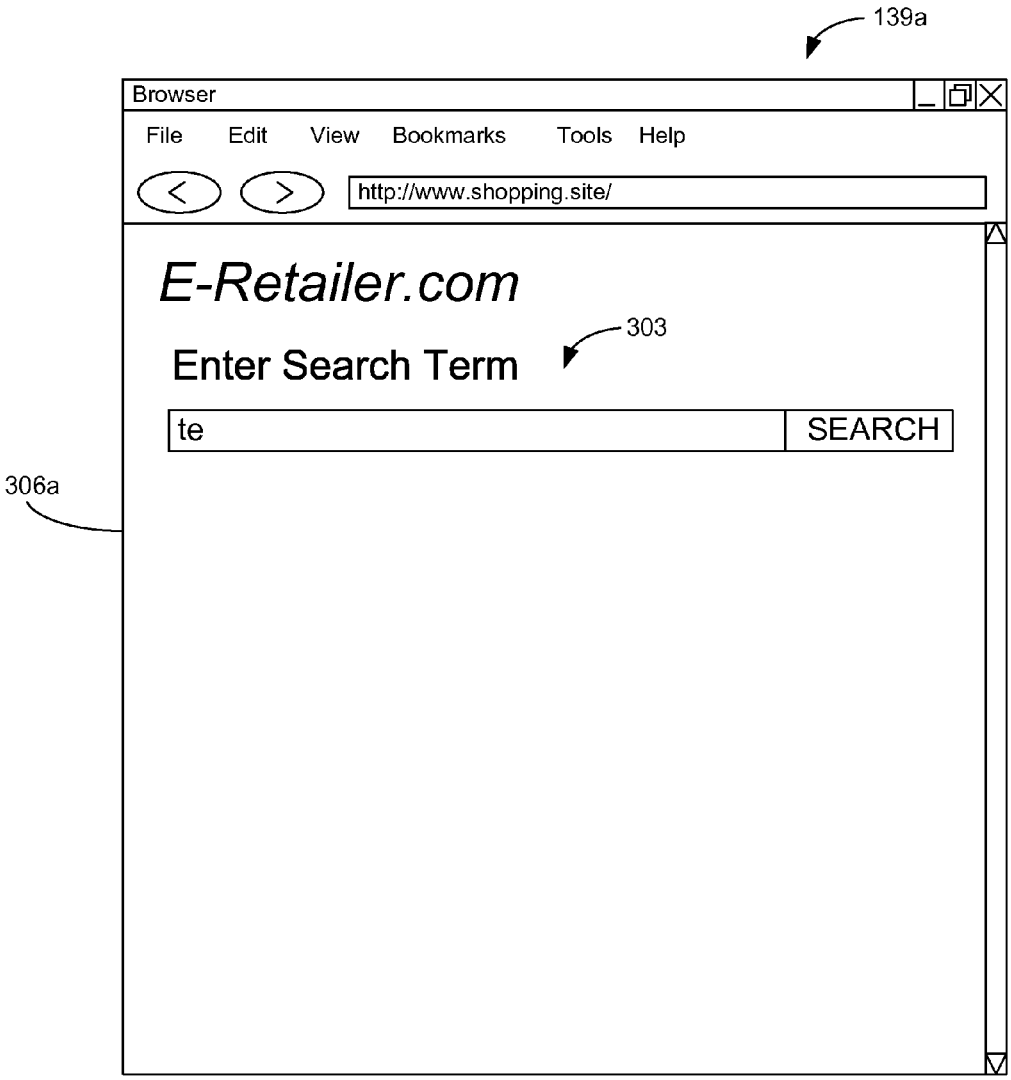
139a
Browser
File Edit View Bookmarks Tools Help
http://www.shopping.site/
E-Retailer.com
303
Enter Search Term
te
SEARCH
306a

FIG. 3A

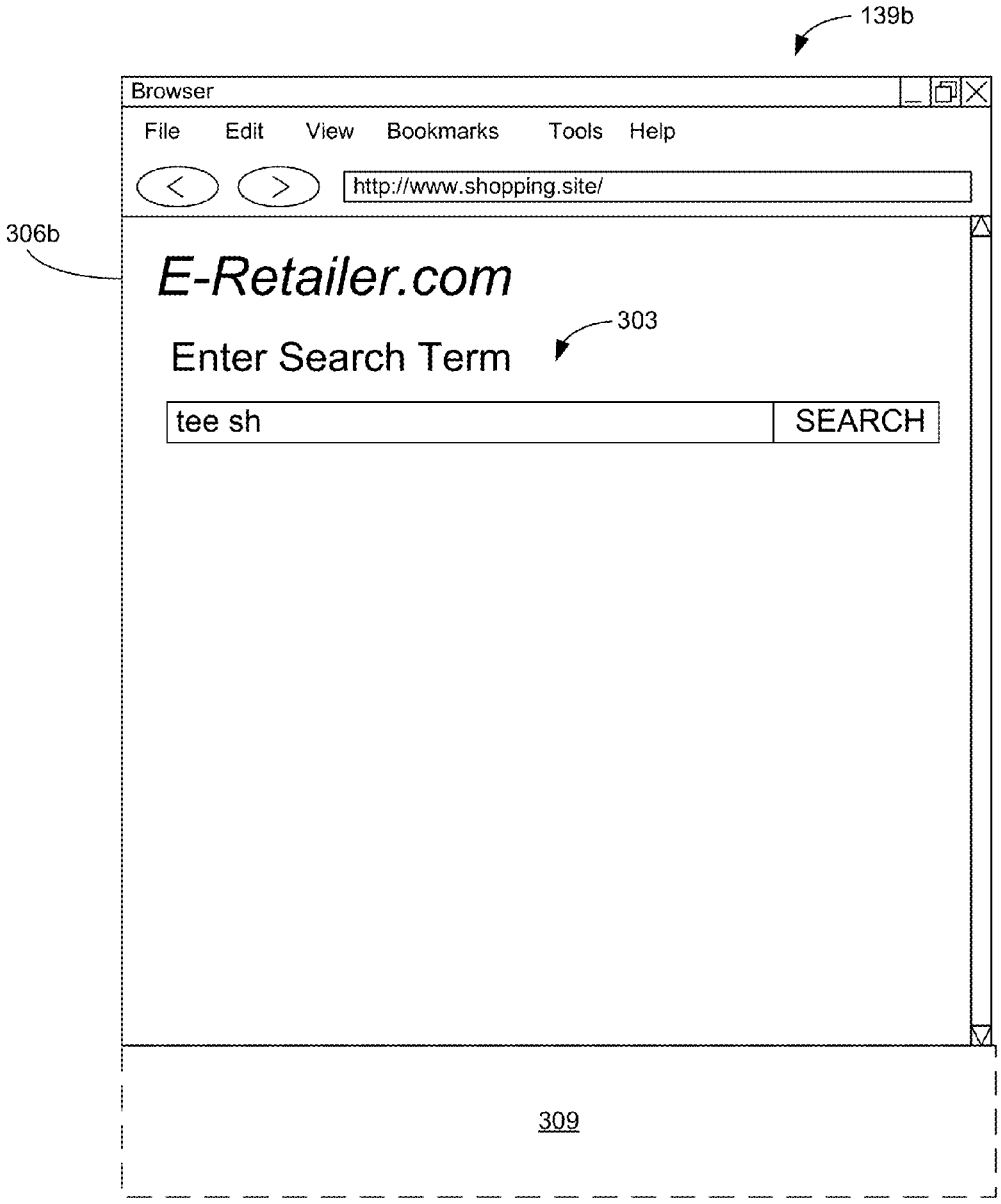
139b
Browser
File Edit View Bookmarks Tools Help
http://www.shopping.site/
306b
E-Retailer.com
303
Enter Search Term
tee sh
SEARCH
309

FIG. 3B

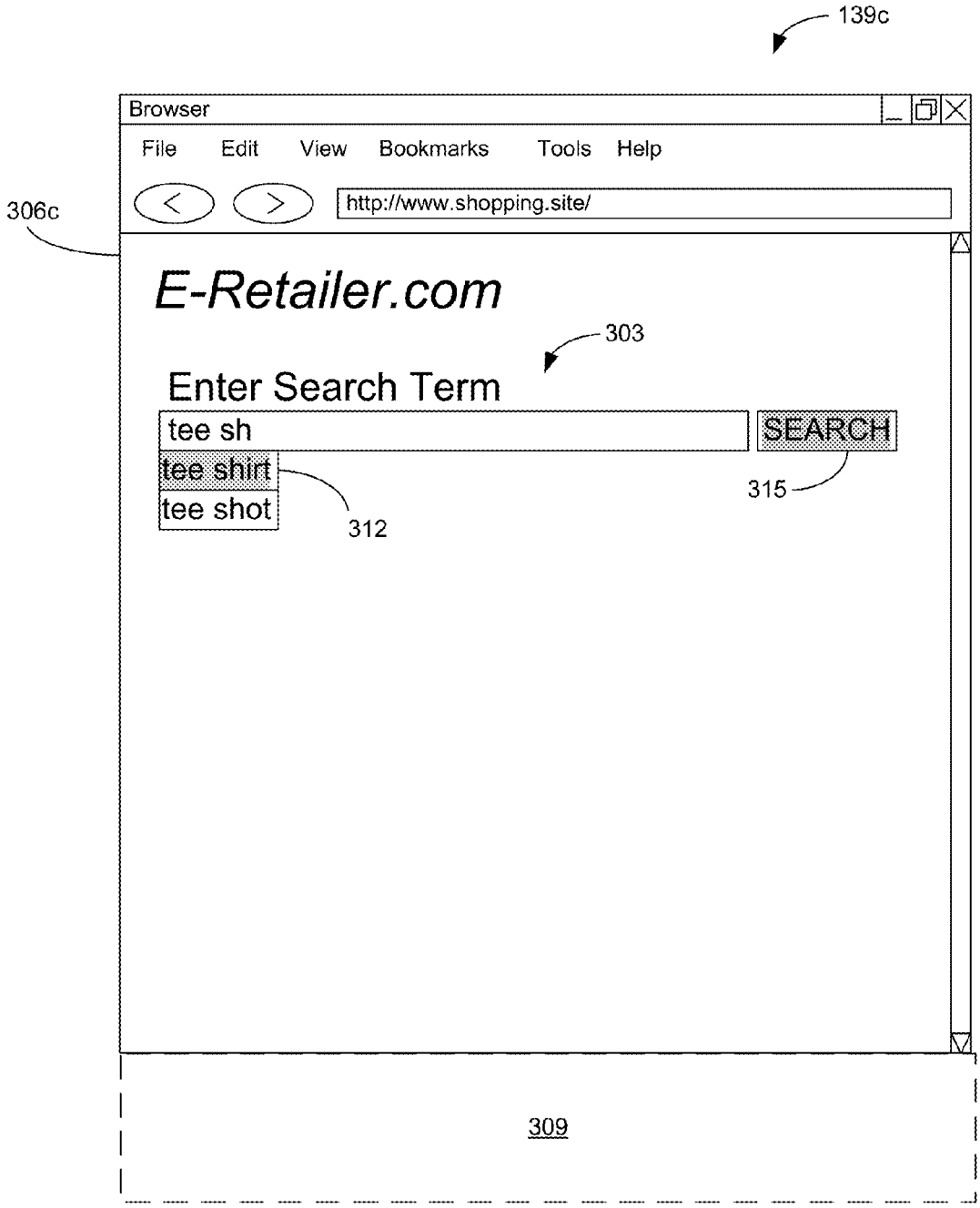
139c
Browser
File Edit View Bookmarks Tools Help
306c
http://www.shopping.site/
E-Retailer.com
303
Enter Search Term
tee sh
SEARCH
tee shirt
tee shot
312
315
309

FIG. 3C

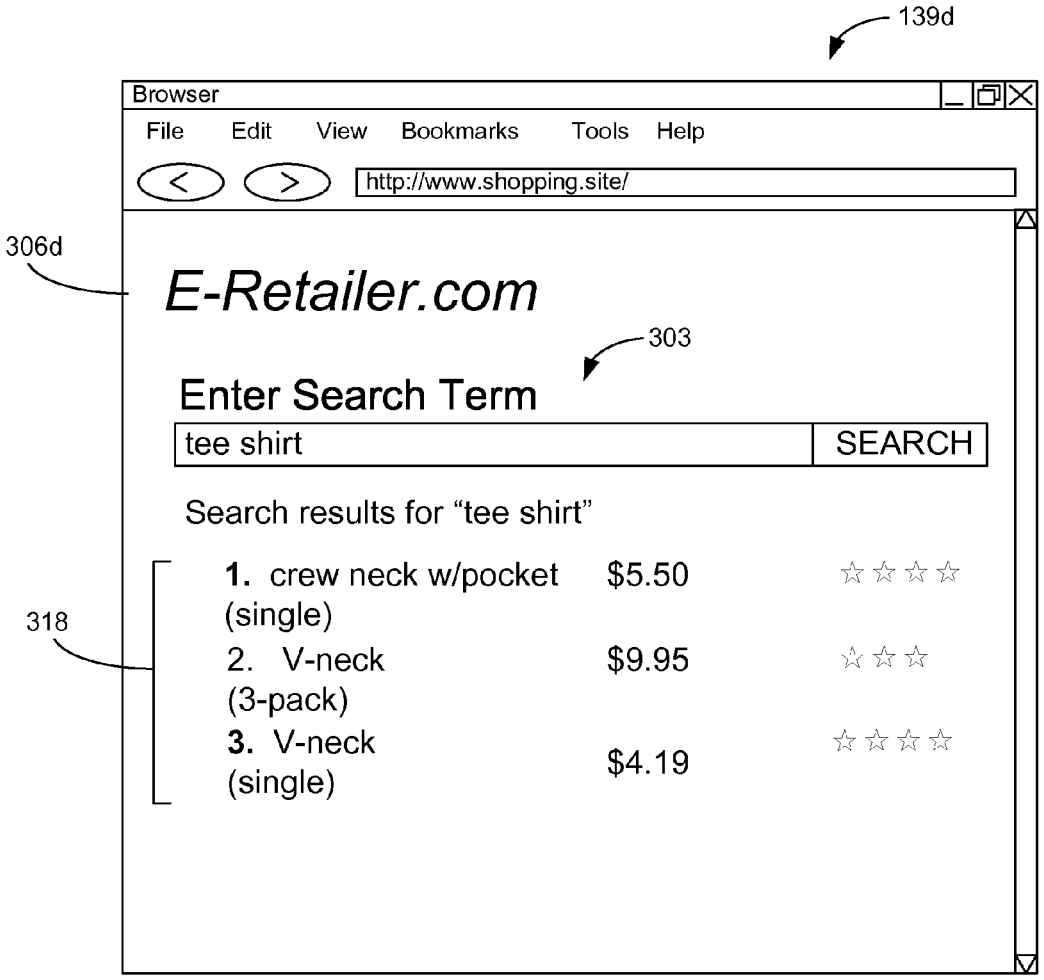
139d
Browser
File Edit View Bookmarks Tools Help
http://www.shopping.site/
306d
E-Retailer.com
303
Enter Search Term
tee shirt
SEARCH
Search results for "tee shirt"
318
1. crew neck w/pocket (single) $5.50
2. V-neck (3-pack) $9.95
3. V-neck (single) $4.19

FIG. 3D

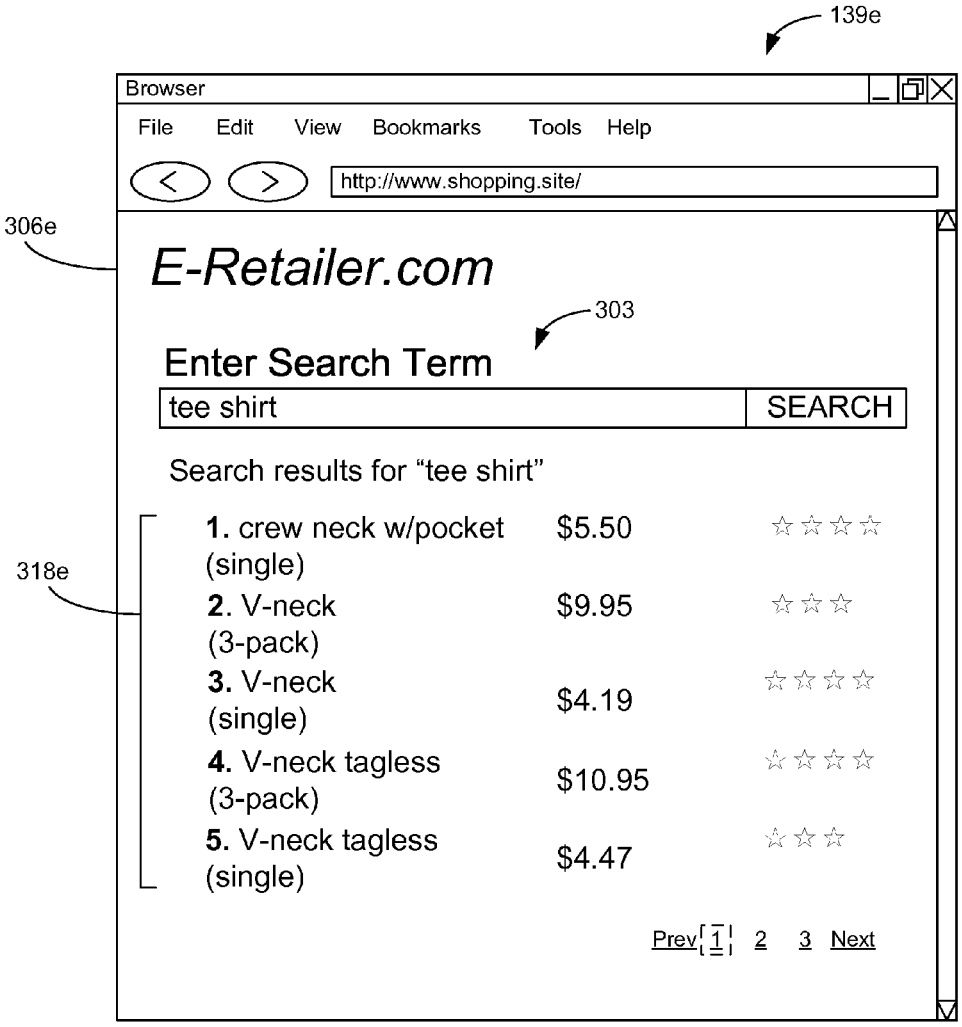
139e
Browser
File Edit View Bookmarks Tools Help
http://www.shopping.site/
306e
E-Retailer.com
303
Enter Search Term
tee shirt
SEARCH
Search results for "tee shirt"
318e
1. crew neck w/pocket (single) $5.50
2. V-neck (3-pack) $9.95
3. V-neck (single) $4.19
4. V-neck tagless (3-pack) $10.95
5. V-neck tagless (single) $4.47
Prev 1 2 3 Next

FIG. 3E

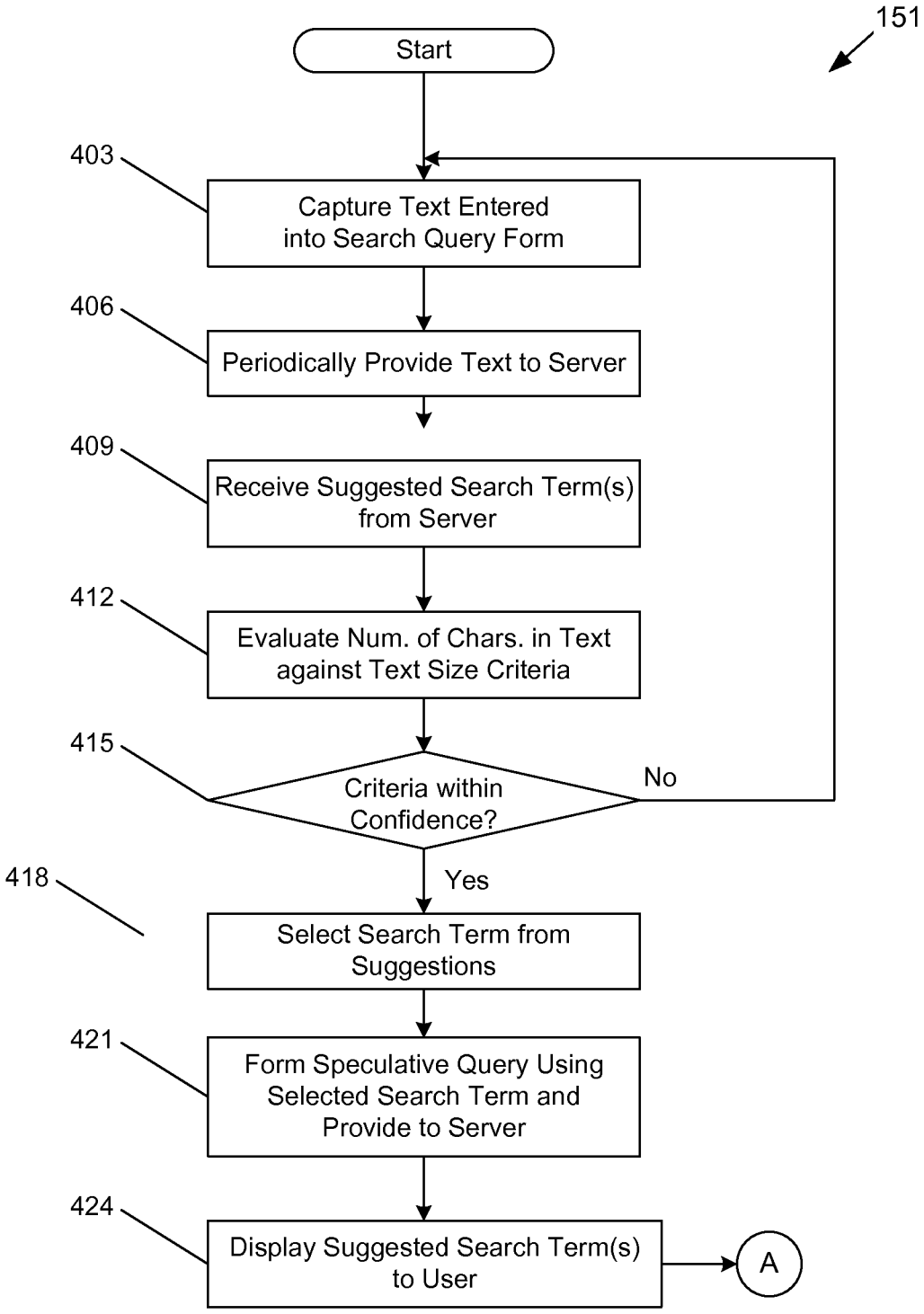
151
Start
403
Capture Text Entered into Search Query Form
406
Periodically Provide Text to Server
409
Receive Suggested Search Term(s) from Server
412
Evaluate Num. of Chars. in Text against Text Size Criteria
415
Criteria within Confidence?
No
Yes
418
Select Search Term from Suggestions
421
Form Speculative Query Using Selected Search Term and Provide to Server
424
Display Suggested Search Term(s) to User
A

FIG. 4A

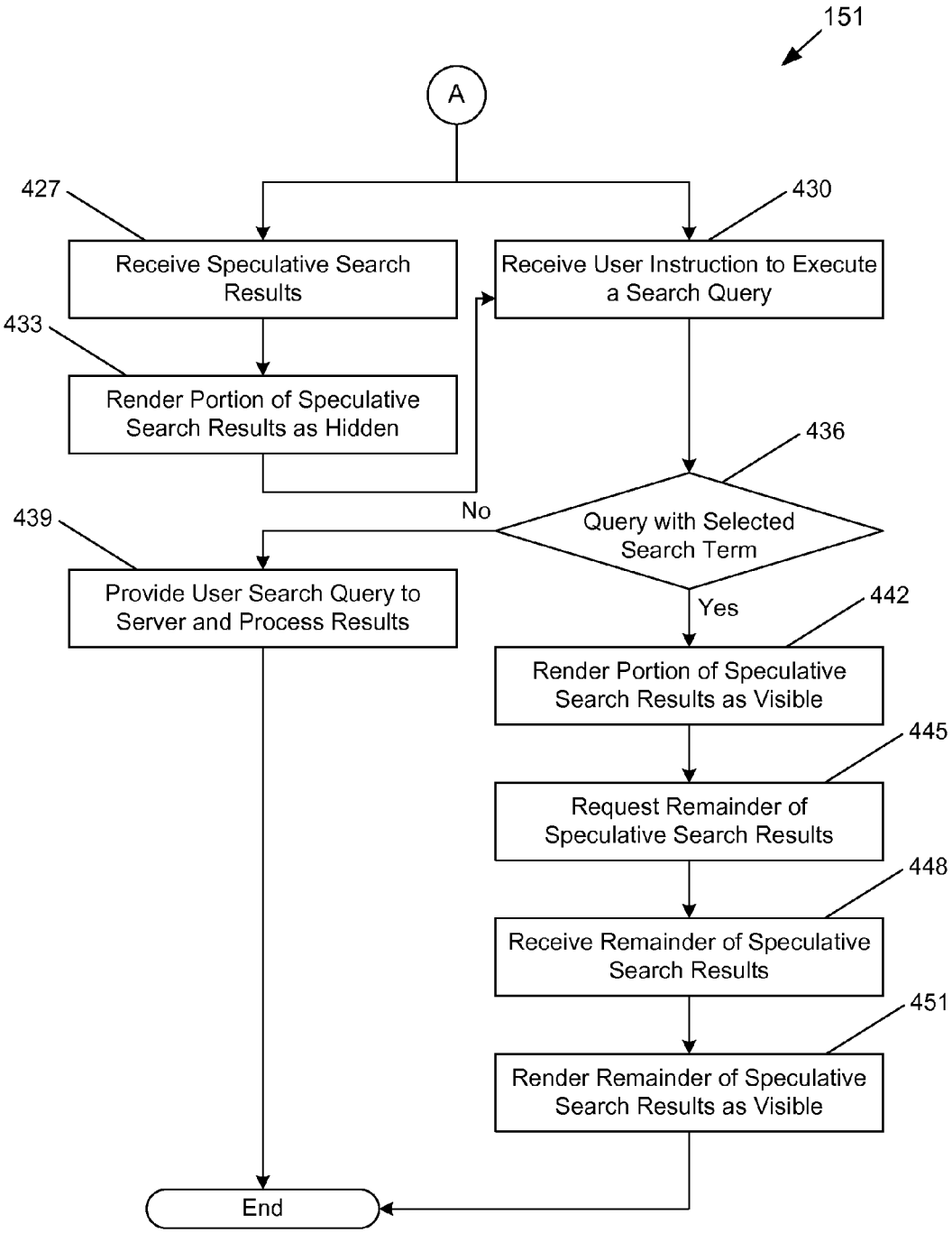
151
A
427
Receive Speculative Search Results
430
Receive User Instruction to Execute a Search Query
433
Render Portion of Speculative Search Results as Hidden
436
Query with Selected Search Term
No
439
Provide User Search Query to Server and Process Results
Yes
442
Render Portion of Speculative Search Results as Visible
445
Request Remainder of Speculative Search Results
448
Receive Remainder of Speculative Search Results
451
Render Remainder of Speculative Search Results as Visible
End

FIG. 4B

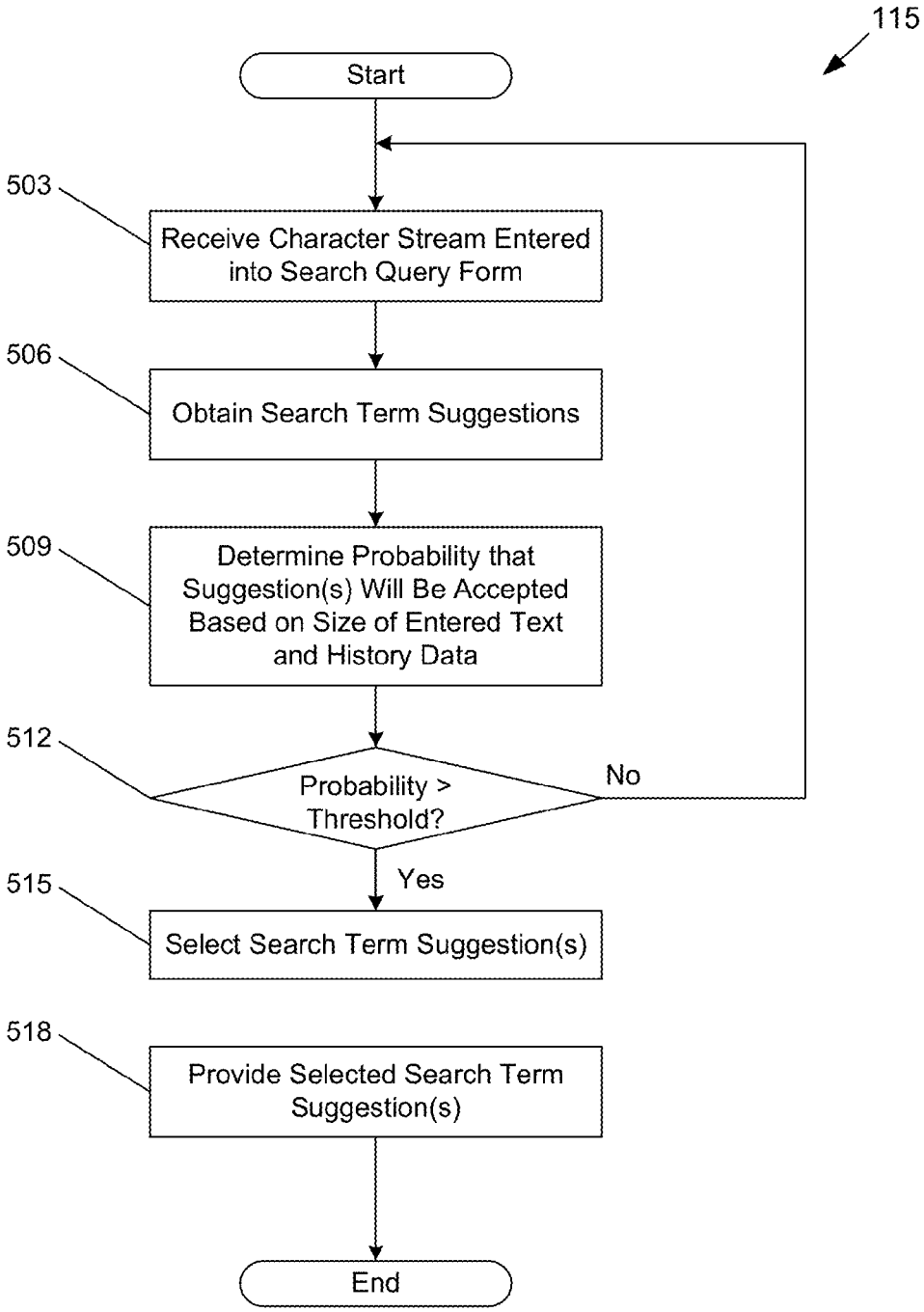
115
Start
503
Receive Character Stream Entered into Search Query Form
506
Obtain Search Term Suggestions
509
Determine Probability that Suggestion(s) Will Be Accepted Based on Size of Entered Text and History Data
512
Probability > Threshold?
No
Yes
515
Select Search Term Suggestion(s)
518
Provide Selected Search Term Suggestion(s)
End

FIG. 5

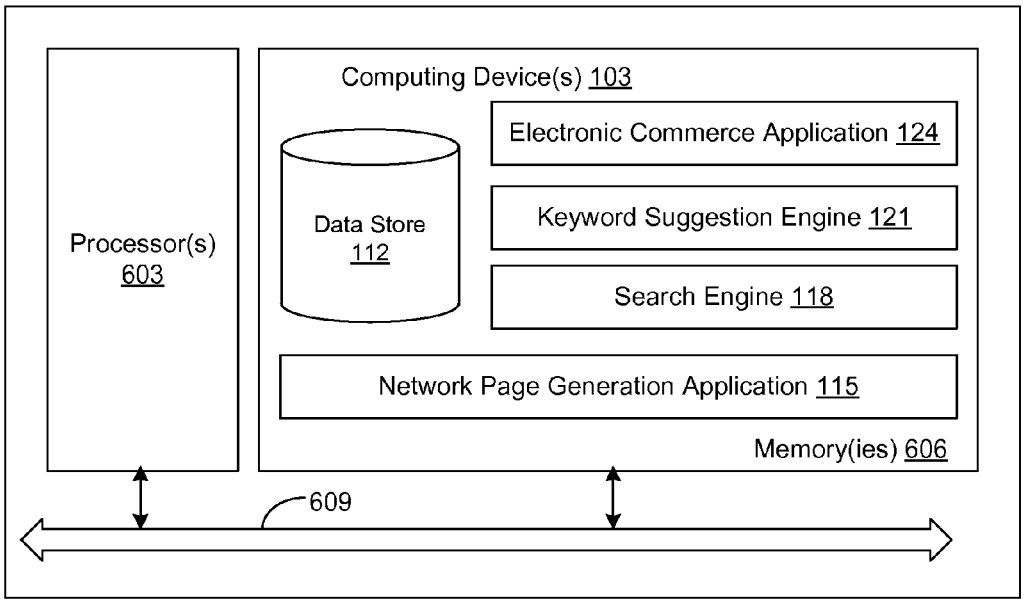
Computing Device(s) 103
Electronic Commerce Application 124
Data Store 112
Keyword Suggestion Engine 121
Search Engine 118
Processor(s) 603
Network Page Generation Application 115
Memory(ies) 606
609

FIG. 6

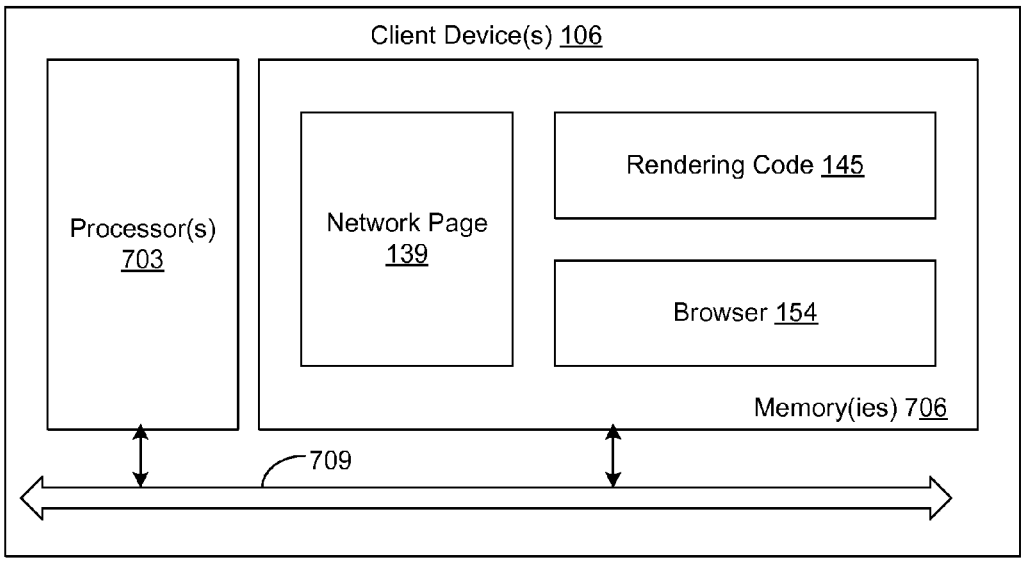
Client Device(s) 106
Processor(s) 703
Network Page 139
Rendering Code 145
Browser 154
Memory(ies) 706
709

FIG. 7

PREDICTIVE PAGE LOADING BASED ON TEXT ENTRY AND SEARCH TERM SUGGESTIONS

BACKGROUND

Online shoppers interact with product search engines to find products of interest and obtain information about those products. As a user enters search terms into a search form, data from past searches may be used to display suggested search terms or search phrases to the user. A user can complete the search query more quickly by accepting one of the search term suggestions.

BRIEF DESCRIPTION OF THE DRAWINGS

Many aspects of the present disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a drawing of a networked environment according to one embodiment of the present disclosure.

FIG. **2** is a block diagram illustrating various interactions between some of the components in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

FIGS. **3**A-E are drawings of examples of a network page rendered by a client device in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

FIGS. **4**A and **4**B form a flowchart illustrating an example of functionality implemented as portions of a browser executed in a client computing device in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

FIG. **5** is a flowchart illustrating an example of functionality implemented as portions of a network page generation application executed in a client computing device in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

FIG. **6** is a schematic block diagram that provides one example illustration of a computing device employed in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

FIG. **7** is a schematic block diagram that provides one example illustration of a client device employed in the networked environment of FIG. **1** according to various embodiments of the present disclosure.

DETAILED DESCRIPTION

The various embodiments described herein relate to search term suggestions provided by a suggestion engine to a browser client. A prediction is made about which search term suggestion(s) is likely to be accepted by a user, based on the number of characters entered by the user into the search query form. A speculative query is formed using the predicted search term suggestion, and results of the speculative query are downloaded to the browser before the user executes a query. These pre-fetched speculative results are rendered in a hidden portion of the browser window. When the user commits to a search query using the predicted search term suggestion, the pre-fetched results are made visible while the browser downloads the remainder of the speculative search results.

With reference to FIG. **1**, shown is a networked environment **100** according to various embodiments. The networked environment **100** includes one or more computing devices **103** in data communication with one or more client devices **106** by way of a network **109**. The network **109** includes, for example, the Internet, intranets, extranets, wide area networks (WANs), local area networks (LANs), wired networks, wireless networks, or other suitable networks, etc., or any combination of two or more such networks.

The computing device **103** may comprise, for example, a server computer or any other system providing computing capability. Alternatively, a plurality of computing devices **103** may be employed that are arranged, for example, in one or more server banks or computer banks or other arrangements. A plurality of computing devices **103** together may comprise, for example, a cloud computing resource, a grid computing resource, and/or any other distributed computing arrangement. Such computing devices **103** may be located in a single installation or may be distributed among many different geographical locations. For purposes of convenience, the computing device **103** is referred to herein in the singular. Even though the computing device **103** is referred to in the singular, it is understood that a plurality of computing devices **103** may be employed in various arrangements.

Various applications and/or other functionality may be executed in the computing device **103** according to various embodiments. Also, various data is stored in a data store **112** that is accessible to the computing device **103**. The data store **112** may be representative of a plurality of data stores as can be appreciated. The data stored in the data store **112**, for example, is associated with the operation of the various applications and/or functional entities described below.

The components executed on the computing device **103** include, for example, a network page generation application **115**, a search engine **118**, and a search term suggestion engine **121**. In some embodiments, the computing device **103** also includes an electronic commerce application **124**. The components executed on the computing device **103** may also include other applications, services, processes, systems, engines, or functionality not discussed in detail herein. These components may communicate with each other using various mechanisms, including but not limited to any type of middleware framework. Though shown as logically separate components, the functionality of the network page generation application **115**, the search term suggestion engine **121**, and the search engine **118** can be combined and/or distributed in various ways, as can be appreciated.

The data stored in the data store **112** includes, for example, network page data **127**, rendering code **145**, a catalog **130** of items **133**, search suggestion history data **136**, and potentially other data. As used herein, the term "item" **133** may refer to a product, good, service, software download, multimedia download, social networking profile, or other item **133** that may be offered for sale, purchase, rental, lease, download, and/or any other form of consumption, as may be appreciated. Associated with items **133** and stored in catalog **130** are data such as titles, descriptions, keywords, metadata, weights, customer reviews, multimedia, and other data relating to the items **133**.

The optional electronic commerce application **124**, if present, is executed in order to facilitate the online viewing and/or purchase of items and products over the network **109**. The electronic commerce application **124** also performs various backend functions associated with the online presence of

a merchant in order to facilitate the online purchase of items, as should be appreciated. In embodiments which include the electronic commerce application **124**, the catalog of items comprises a product catalog of items offered for sale, so that data associated with items **133** comprises product data.

The search engine **118** is executed to find items **133** in the catalog **130** using a search query. To provide content in response to user queries, content associated with item(s) retrieved by a query may be retrieved from the catalog data and encoded for display in a client device **106** by the network page generation application **115**.

The search term suggestion engine **121** is executed to provide suggested search terms as a user enters text into a search query form. The search term suggestion engine **121** selects one or more search terms that a user is likely to be interested in using search suggestion history data **136** stored in the data store **112**. The search suggestion history data **136** may be derived, for example, from historical user data collected by a search profiling service or another application based on previous search queries, page view data, and/or other data. The search suggestion history data **136** may be indexed for a particular user, or may be aggregated across users. In some embodiments, search terms can be suggested to a user based upon matching various aspects of a profile of a user with specific items in the catalog **130**. In some embodiments, search terms can be suggested based on the popularity of certain search terms among other users or other factors as can be appreciated. In some embodiments, when used in conjunction with an electronic commerce application **124**, search terms can also be suggested to the user based upon the shopping history or preferences of the user, or the popularity of particular items in the catalog **130**. The search term suggestion engine **121** provides the one or more suggested search terms to the client device **106**, where the search terms may be presented to the user and/or used to issue a speculative search query as described in further detail below.

The network page generation application **115** is executed to generate network pages **139** that describe items **133** located through a search or by browsing the catalog **130**. To this end, the network page generation application **115** uses network page data **127**, which may include any type of data related to the generation of network pages **139**. Such data may include, for example, templates, executable code, interpreted code, hypertext markup language (HTML), extensible markup language (XML), images, video, text, graphics, and any other type of data that may be used in network pages **139**.

The network page generation application **115** may include a network page server and/or other components. The network page server may comprise a commercially available hypertext transfer protocol (HTTP) server such as, for example, Apache® HTTP Server, Microsoft® Internet Information Services (IIS), and other servers.

As described in further detail below, the network page generation application **115** may also add results from a speculative search query to a network page **139**. Thus, the network page **139** may include speculative search results **142** and rendering code **145** as well as other content. The combination of the speculative search results **142** and the rendering code **145** stored on a network page **139** allows the client device **106** to pre-load and to render more quickly search results from a query that a user is expected to perform, based on search terms provided by the search term suggestion engine **121**. In some embodiments, the speculative search results **142** correspond to the portion of the search results network page **139** that is first seen by the user, a region sometimes referred to as "above the fold."

The network page generation application **115** may be configured to generate the rendering code **145** for a specific network page **139** and/or client device **106** based on stored rendering code **148** in the data store **112**. The specific rendering code **145** and the stored rendering code **148** may include, for example, Javascript, dynamic HTML (DHTML), Ajax, and any other type of code that may be executed in a client device **106** from within a network page **139**. The specific rendering code **145** and the stored rendering code **148** may also include asynchronous exchange of data with the network page generation application **115**, the search term suggestion engine **121**, the search engine **118**, or other applications using Ajax, simple object access protocol (SOAP), remote procedure call (RPC), and/or other technologies.

Having discussed the computing device **103**, the client device **106** will now be considered. The client device **106** is representative of a plurality of client devices that may be coupled to the network **109**. The client device **106** may comprise, for example, a processor-based system such as a computer system. Such a computer system may be embodied in the form of a desktop computer, a laptop computer, a personal digital assistant, a cellular telephone, a set-top box, a music player, a video player, a media player, a web pad, a tablet computer system, a game console, an electronic book reader, or other devices with like capability.

The client device **106** may be configured to execute various applications such as a browser **151** and other applications. The browser **151** may be executed in a client device **106**, for example, to access and render network pages **139** or other network content served up by the network page generation application **115**, thereby generating a rendered network page. The client device **106** may be configured to execute applications beyond the browser **151** such as, for example, email applications, instant message applications, and/or other applications.

Turning to FIG. **2**, a general description of the operation of the various components of the networked environment **100** is provided. To begin, at event **203** a user at a client device **106** interacts with the browser **151** by entering text into a search query form. At block **206**, the browser **151** stores characters as the user enters text into the form. At some point after one or more characters are entered, at event **209** the browser **151** forwards the text to the computing device **103** over the network **109** (FIG. **1**), where the text is processed by the search term suggestion engine **121**. At event **212**, the computing device **103** provides a list of one or more suggested search terms to the browser **151**.

At block **215**, the browser **151** determines if the characters entered so far provide enough information to confidently predict which suggested search term the user will select to form the search query. This determination is made by analyzing characteristics of the text entered so far and comparing those characteristics to one or more text criteria, as described in more detail below. In other embodiments (not shown) the determination as to whether a prediction is confident may occur on the computing device **103** rather than on the client device **106**. In the particular example scenario of FIG. **2**, it is assumed that the characteristics of the entered text do not meet the criteria, so more text will be processed before predicting a search query.

To this end, at event **218** continues to enter characters into the search query form, and the new characters are stored by the browser **151** at block **221**. The browser **151** forwards the new characters to the computing device **103** at event **224**. Alternatively, the browser **151** may forward all text entered so far. The computing device **103** uses the new information to provide to the browser **151** at event **227** a new list of suggested

search terms. Alternatively, an updated list of new and previously provided search terms can be provided. As used herein, "search term" is not limited to a single word, but covers compounds and phrases. Thus, "harry" is considered a search term, as is "harry potter." Thus, the number of terms is not always the same as the number of words. For example, a list of suggested search terms for block **227** might include three separate search terms: "harry connick," and "harry potter."

At block **230**, the browser **151** uses the text size information to determine if the characters entered so far provide enough information to confidently predict which suggested search term the user will select to form the search query. In the particular example scenario of FIG. **2**, it is assumed that the text entered at this point does meet the confidence criteria.

At block **233**, the browser **151** selects the first suggested search term provided by the computing device **103**. The browser **151** forms a search query using the predicted search term, and issues the search query to the computing device **103** at event **236**. The first suggested search term can thus be considered a predicted search term, and the search query can be considered a speculative search query. Other embodiments support multiple predicted search terms by selecting the first N suggested search terms are selected, where N>1. Embodiments which support multiple predicted search terms may use one query per search term, or may bundle more than one search term into a single query.

At block **239**, the computing device **103** obtains results for the speculative search query and generates a network page **139** which includes the speculative search results as well as rendering code **145**. The speculative search results may be a complete list of search results, or may be only a partial list. At block **242**, the network page **139** is processed and rendered by the browser **151**. During this processing, the rendering code **145** on the network page **139** executes on the client device **106** to render the speculative search results in a hidden portion of the browser **151**. The browser **151** has thus pre-loaded at least a first portion of search results for a speculative query.

At event **245**, the user performs the search using the predicted search term. In this manner, one of the once-speculative queries becomes a confirmed query. In this example scenario, the speculative search results are only partial results, so at block **251**, the rendering code **145** requests the remaining portion of the search results for the speculative query from the network page generation application **115**. Next, at block **248** the rendering code **145** executes to make the pre-loaded hidden speculative search results **142** visible in the browser **151**. While block **251** (download remainder) is shown before block **248** (partial render), the order can also be reversed, or the two actions can run substantially concurrently.

At event **254**, the remainder of the search results network page **139** is downloaded, and at block **257** the rendering code **145** renders an updated view of the network page **139** so that the remainder of the search results are visible. In some embodiments, the updated view makes the entire new network page **139** visible. In other embodiments, the updated view includes an element such as a viewport, scroll bar, etc., which allows the user to take action to make the remainder visible.

In this manner, the user experience is enhanced by making a prediction about which search queries the user will perform and speculative issuing those queries, since the pre-fetched results can be rendered when the user commits to the query. Without this prediction, the download of the search results page would be delayed until the user committed to the query. As described above, the user does not see the speculative search results until user action results in issuance of a committed query containing one of the search term suggestions. The browser embodiment described in connection with FIG. **2** accomplished this by rendering the speculative search results in a hidden portion of the browser window. Other browser embodiments accomplish this by locally storing the speculative search results when they are returned from the computing device **103**, but delaying the display of the speculative search results until a user action causes the committed query to be issued.

In some embodiments, the prediction mechanism describe above is used repeatedly. To this end, when returning the remainder of the once-speculative but now-committed search results to the browser **154**, the page generation application **115** may also include a portion of another set of speculative search results. The page generation application **115** may decide on a page-by-page basis whether to include additional speculative results along with the remainder data for the last set of speculative results. In some embodiments, the browser does not specifically encode a request for the remainder, but may instead generically encode a request for another network page. In this case, the network page generation application **115** uses stored context to determine that the requested page should include another set of speculative results. The operation of the rendering code **145** will now be described in the context of examples of network pages **139** that are rendered in a browser **151**.

FIGS. **3**A-E illustrate examples of a network page **139**, denoted herein as **139***a*, **139***b*, **139***c*, **139***d*, and **139***e*, rendered by a browser **151** executing in client device **106** in the networked environment **100**. As noted above, the network page **139** is a search result page that is generated by the network page generation application **115**. FIGS. **3**A-E illustrate various stages of predicting, issuing, and rendering a search query of "tee shirts."

Referring to FIG. **3**A, the network page **139***a* includes a search query component **303** in a visible portion **306***a* of the page. A user enters text for a search query into the search query component **303**. The search query component **303** may be implemented, for example, as an HTTP form. In the example of FIG. **3**A, the user has entered two keys, "t" and "e." As explained above, these keys are provided by the browser **151** to the search term suggestion engine **121** in the computing device **103**, which suggests search terms based on the text entered by the user. In the example of FIG. **3**A, the search term suggestion engine **121** has not yet provided suggestions, and no search query has been issued.

Moving on to FIG. **3**B, shown is the network page **139***b*, which includes the search query component **303** in the visible portion **306***b* of the page. This network page **139***b* illustrates the user entering more text: "e sh." In this example, the search term suggestion engine **121** has provided a suggestion list including "tee shirt," and the browser **151** has determined that the characteristics of the entered text allows a confident prediction that the user will select the search term "tee shirt" when that suggestion is shown to the user. As a result of this confident prediction, the browser **151** has preemptively issued the speculative search query "tee shirt" and received speculative search results. In other words, the retrieval of speculative search results occurs before, and is independent of, the user action which actually requests the search. However, since the user has not yet committed to a search query, the speculative search results are stored in a hidden portion **309** of the network page **139***a*, which is not visible in the browser **151**.

Turning now to FIG. **3**C, shown is another network page **139***c* which includes the search query component **303** in the visible portion **306***c* of the page. As noted above, the search

term suggestion engine **121** has already provided a suggestion list including "tee shirt." This network page **139***b* illustrates that this suggestion is shown to the user by means of drop-down list box **312**. This network page **139***b* illustrates that the user has committed to the search query by selecting the "Search" button **315**.

With reference now to FIG. **3**D, shown is another network page **139***d* which is rendered in response the user committing to the speculative search. The pre-loaded speculative search results are rendered by the rendering code **145** in a list **318** in the visible portion **306***d* of the page. Since these three items were obtained before the user committed to the search, they are made visible without a delay while the remainder of the results from the committed search query is retrieved as described above in connection with FIG. **2**. While three items were pre-loaded in this particular example, the number of pre-loaded items is a design choice, as should be appreciated.

Referring now to FIG. **3**E, shown is another network page **139***e* which is rendered by the rendering code **145** when the download of the committed search query is complete. All five items of the search results are now visible in the visible portion **306***e* of the page in the search results list **318***e*.

Having described the overall process of predicting search terms likely to be entered by a user into a search query and using the prediction to fetch a speculative search results network page **139** before a user commits to the search, the operation of the client side components will now be described in more detail. Turning now to FIGS. **4**A and **4**B, shown is a flowchart that provides one example of the operation of a portion of the browser **151** (FIG. **1**) according to various embodiments. It is understood that the flowchart of FIGS. **4**A and **4**B provides merely an example of the many different types of functional arrangements that may be employed to implement the operation of the portion of the browser **151** as described herein. As an alternative, the flowchart of FIGS. **4**A and **4**B may be viewed as depicting an example of steps of a method implemented in the client device **106** (FIG. **1**) according to one or more embodiments.

Beginning at box **403** in FIG. **4**A, the browser **151** captures text as it is entered by a user into a search query component **303** within a search results network page **139**. The browser **151** periodically provides the text to the computing device **103**, for processing by the search term suggestion engine **121**, at box **406**. Next, at box **409** the browser **151** receives one or more suggested search terms from the computing device **103**. Having received at least one suggested search term, the browser **151** determines whether a prediction can be made, with confidence, that one of the suggested search terms will be accepted by the user. Once a confident prediction is available, a speculative search query can be issued for the suggested search term, before the user actually chooses the search term and executes a search. The prediction of whether a suggested search term will be selected by the user at a particular point in time is based on the number of characters in the search query at that time, as follows.

At box **412** the browser **151** evaluates the entered text in accordance with one or more text characteristics confidence criteria. Such criteria may include, for example: number of characters in the entered text exceeds a predefined threshold; number of characters in the entered text exceeds a predefined percentage of the first search term suggested by the search term suggestion engine **121**; and identity of characters within the entered text. Some embodiments may combine multiple text size criteria. In some embodiments, the predefined threshold depends on the current search category in which the user performs the search.

In some embodiments, the confidence criteria is expressed in terms of specific characters or key combinations. For example, the browser may consider the confidence criteria to be met as soon as the user enters a character indicating a word break (e.g. a space). Some characters or character sequences may be treated as confident predictors while others are not, e.g., "ip" may confidently predict "ipad" or "ipod," while "t" and "th" may not lead to confident predictions. The search term suggestion engine **121** may provide these character-specific or sequence-specific probabilities back to the browser **151**. For example, if the user types "ip" the engine **121** may provide "ipad" and "ipod" as suggested search terms, along with respective probabilities that the user will choose these suggestions.

As another example, the browser **151** may consider the confidence criteria to be met when the user enters a key combination that indicates text was pasted from the clipboard (e.g., ctrl-v). The confidence criteria may also be expressed in terms of a user action (e.g., paste) rather than a specific key, since a user may paste text by using a menu instead of a key. The predefined thresholds may be configurable. In some embodiments, the predefined thresholds are empirically determined based on past user behavior data. This past user behavior data may describe the conditional probability of a user accepting suggested search terms when the text entered meets specific size conditions. For example, the past user behavior data may show that the probability of a user accepting the first search term suggestion is 35% when the user has entered only one character, 40% when the user has entered only two characters, and 50% when the user has entered eight characters. With such data, the browser **151** may use the total number of characters as a confidence parameter and the confidence criteria may be set to eight characters, to ensure a relatively high confidence level (50%) that the user will select one of the search terms suggested by the search term suggestion engine **121**.

At box **415**, the browser **151** compares the size of the text to the text size confidence criteria. If the text size does not meet the criteria, the browser **151** continues to monitor new text by repeating boxes **403** through **412** until a confident prediction can be made, or until a user executes a search query. If at box **415** it is determined that the text size does meet the text size confidence criteria, then processing continues at box **418**, where the browser **151** selects a search term from those suggested search terms provided by the computing device **103** at box **409**. In some embodiments, the first search term suggestion is selected. In other embodiments, more than one search term suggestion may be selected.

Next, at box **421** the browser **151** forms a speculative search query from the selected search term and provides the speculative search query to the computing device **103**. At box **424**, the selected search term is displayed to the user in the search query component **303**.

The flowchart continues at box in FIG. **4**B, where one of two events is processed. Box **427** is executed if the browser **151** next receives results from the speculative search query issued in box **421**, while box **430** is executed if the browser **151** next receives a user instruction to execute a search query. Once the speculative search results are received at box **427**, the rendering code **145** executes in the browser **151** at box **433** to render speculative search results in a hidden portion of the browser **151**. In the embodiment discussed here in connection with FIGS. **4**A and **4**B, the speculative search results provided by the computing device **103** represent only a portion of the entire results, with the remainder being fetched later. In other embodiments, the computing device **103** provides the

entire search result set at one. Having hidden the speculative search results, processing then continues at box **430**.

Box **430** is executed when the browser **151** receives a user instruction to execute a search query, which may occur before or after speculative search results are received. Next, at box **436** the browser **151** determines whether the query executed by the user corresponds to the suggested search term used in the speculative search results, or to a different search term. If the user did not execute a query for the speculative search term, then at box **439** the browser **151** provides the user's search term to the computing device **103**. Since the speculative search query was incorrect (a "miss") the search results are processed in a conventional manner, and the search query process of FIGS. **4**A and **4**B is complete.

If instead it is determined at box **436** that the query executed by the user corresponds to the suggested search term used in the speculative search results, then at box **442** the rendering code **145** re-renders the previously received first portion of the speculative results, this time in the visible portion of the browser **151**. Next, at box **445** the browser **151** requests any remaining portion of the speculative search results, since the query was confirmed by the user. At box **448**, the browser **151** receives the requested remainder, and at box **451** the browser **151** renders the remainder in the visible portion of the browser **151**. At this point, all results for first-speculative and now-confirmed search query are visible, both the pre-loaded partial results and the just received remainder. The process of FIGS. **4**A and **4**B is then complete.

As described above, the user does not see the partial page content until the user action views the predicted network page **139**. The browser embodiment described in connection with FIGS. **4**A and **4**B accomplished this by rendering the partial predicted page content in a hidden portion of the browser window. Other browser embodiments accomplish this by locally storing the partial predicted page content when it is returned from the computing device **103**, but delaying the display of the partial predicted page content until a user action causes the predicted network page **136** to be accessed.

Moving on to FIG. **5**, shown is a flowchart that provides one example of the operation of a portion of the network page generation application **115** (FIG. **1**) according to various embodiments. It is understood that the flowchart of FIG. **5** provides merely an example of the many different types of functional arrangements that may be employed to implement the operation of the portion of the network page generation application **115** as described herein. As an alternative, the flowchart of FIG. **5** may be viewed as depicting an example of steps of a method implemented in the computing device **103** (FIG. **1**) according to one or more embodiments.

In the embodiments described in connection with FIGS. **4**A and **4**B, the browser **151** receives periodic search term suggestions from the network page generation application **115** and decides when a user is likely to accept one of the search term suggestions, based on the number of characters entered by the user into a search query. In contrast, in the embodiment described in connection with FIG. **5** it is the network page generation application **115** that decides when a search term suggestion is likely to be accepted, based on the number of characters entered by the user into the search query. As described above in connection with FIG. **4**, specific characters or key combinations (e.g., space, ctrl-v) may be treated as a confident prediction, and some characters or character sequences may be treated as confident predictors while others are not.

Beginning at box **503**, the network page generation application **115** receives a stream of one or more characters from the browser **151**, representing text entered by the user into a search query. At box **506**, the network page generation application **115** obtains, from the search term suggestion engine **121**, one or more suggested search terms. The suggestions are based on the text provided at box **503**. Next, at box **509**, the network page generation application **115** uses the size of the text entered by the user, along with search suggestion history data **136**, to determine the probability that one of the suggestions will be accepted by the user.

At box **512**, the network page generation application **115** compares the probability to a predefined threshold. If the probability is below the threshold, the network page generation application **115** continues to receive new characters in the text stream by repeating boxes **503** through **509** until the required probability can be obtained, or until the network page generation application **115** receives a search query executed by the user. If at box **512** it is determined that the probability is at or above the threshold, then processing continues at box **515**.

At this point, any of the search term suggestions are good candidates for selection by the user for a search query, since the decision is based on how many characters the user has entered rather than the specific search terms. At box **515**, the network page generation application **115** selects at least one search term from those suggested search terms obtained from the search term suggestion engine **121** at box **506**. In some embodiments, the first search term suggestion is selected. In other embodiments, more than one search term suggestion may be selected. Next, at box **518**, the network page generation application **115** provides the selected search term suggestions to the browser **151**. The process of FIG. **5** is then complete.

Turning now to FIG. **6**, shown is a schematic block diagram of the computing device **103** according to an embodiment of the present disclosure. The computing device **103** includes at least one processor circuit, for example, having a processor **603** and a memory **606**, both of which are coupled to a local interface **609**. To this end, the computing device **103** may comprise, for example, at least one server computer or like device. The local interface **609** may comprise, for example, a data bus with an accompanying address/control bus or other bus structure as can be appreciated.

Stored in the memory **606** are both data and several components that are executable by the processor **603**. In particular, stored in the memory **606** and executable by the processor **603** are the network page generation application **115**, the search engine **118**, the electronic commerce application **124**, the search term suggestion engine **121**, and potentially other applications. Also stored in the memory **606** may be a data store **112** and other data. In addition, an operating system may be stored in the memory **606** and executable by the processor **603**.

With reference now to FIG. **7**, shown is a schematic block diagram of the computing device **103** according to an embodiment of the present disclosure. The computing device **103** includes at least one processor circuit, for example, having a processor **703** and a memory **706**, both of which are coupled to a local interface **709**. To this end, the computing device **103** may comprise, for example, at least one server computer or like device. The local interface **609** may comprise, for example, a data bus with an accompanying address/control bus or other bus structure as can be appreciated.

Stored in the memory **706** are both data and several components that are executable by the processor **703**. In particular, stored in the memory **706** and executable by the processor **703** are the browser **151**, the rendering code **145**, and poten-

tially other applications. In addition, an operating system may be stored in the memory **706** and executable by the processor **703**.

It is understood that there may be other applications that are stored in the memory **606**, **706** and are executable by the processor **603**, **703**, as can be appreciated. Where any component discussed herein is implemented in the form of software, any one of a number of programming languages may be employed such as, for example, C, C++, C#, Objective C, Java, Javascript, Perl, PHP, Visual Basic, Python, Ruby, Delphi, Flash, or other programming languages.

A number of software components are stored in the memory **606**, **706** and are executable by the processor **603**, **703**. In this respect, the term "executable" means a program file that is in a form that can ultimately be run by the processor **603**, **703**. Examples of executable programs may be, for example, a compiled program that can be translated into machine code in a format that can be loaded into a random access portion of the memory **606**, **706** and run by the processor **603**, **703**, source code that may be expressed in proper format such as object code that is capable of being loaded into a random access portion of the memory **606**, **706** and executed by the processor **603**, **703**, or source code that may be interpreted by another executable program to generate instructions in a random access portion of the memory **606**, **706** to be executed by the processor **603**, **703**, etc. An executable program may be stored in any portion or component of the memory **606**, **706** including, for example, random access memory (RAM), read-only memory (ROM), hard drive, solid-state drive, USB flash drive, memory card, optical disc such as compact disc (CD) or digital versatile disc (DVD), floppy disk, magnetic tape, or other memory components.

The memory **606**, **706** is defined herein as including both volatile and nonvolatile memory and data storage components. Volatile components are those that do not retain data values upon loss of power. Nonvolatile components are those that retain data upon a loss of power. Thus, the memory **606**, **706** may comprise, for example, random access memory (RAM), read-only memory (ROM), hard disk drives, solid-state drives, USB flash drives, memory cards accessed via a memory card reader, floppy disks accessed via an associated floppy disk drive, optical discs accessed via an optical disc drive, magnetic tapes accessed via an appropriate tape drive, and/or other memory components, or a combination of any two or more of these memory components. In addition, the RAM may comprise, for example, static random access memory (SRAM), dynamic random access memory (DRAM), or magnetic random access memory (MRAM) and other such devices. The ROM may comprise, for example, a programmable read-only memory (PROM), an erasable programmable read-only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM), or other like memory device.

Also, the processor **603**, **703** may represent multiple processors and the memory **606**, **706** may represent multiple memories that operate in parallel processing circuits, respectively. In such a case, the local interface **609**, **709** may be an appropriate network **109** (FIG. **1**) that facilitates communication between any two of the multiple processors **603**, **703**, between any processor **603**, **703** and any of the memories **606**, **706**, or between any two of the memories **606**, **706**, etc. The local interface **609**, **709** may comprise additional systems designed to coordinate this communication, including, for example, performing load balancing. The processor **603**, **703** may be of electrical or of some other available construction.

Although the network page generation application **115**, the search engine **118**, the electronic commerce application **124**, the search term suggestion engine **121**, the browser **151**, the rendering code **145**, and other various systems described herein may be embodied in software or code executed by general purpose hardware as discussed above, as an alternative the same may also be embodied in dedicated hardware or a combination of software/general purpose hardware and dedicated hardware. If embodied in dedicated hardware, each can be implemented as a circuit or state machine that employs any one of or a combination of a number of technologies. These technologies may include, but are not limited to, discrete code circuits having code gates for implementing various code functions upon an application of one or more data signals, application specific integrated circuits having appropriate code gates, or other components, etc. Such technologies are generally well known by those skilled in the art and, consequently, are not described in detail herein.

The flowcharts of FIGS. **4-5** show the functionality and operation of an implementation of portions of the network page generation application **115** and the browser **151**. If embodied in software, each block may represent a module, segment, or portion of code that comprises program instructions to implement the specified logical function(s). The program instructions may be embodied in the form of source code that comprises human-readable statements written in a programming language or machine code that comprises numerical instructions recognizable by a suitable execution system such as a processor **603**, **703** in a computer system or other system. The machine code may be converted from the source code, etc. If embodied in hardware, each block may represent a circuit or a number of interconnected circuits to implement the specified logical function(s).

Although the flowcharts of FIGS. **4-5** show a specific order of execution, it is understood that the order of execution may differ from that which is depicted. For example, the order of execution of two or more blocks may be scrambled relative to the order shown. Also, two or more blocks shown in succession in flowcharts of FIGS. **4-5** may be executed concurrently or with partial concurrence. Further, in some embodiments, one or more of the blocks shown in FIGS. **4-5** may be skipped or omitted. In addition, any number of counters, state variables, warning semaphores, or messages might be added to the flow described herein, for purposes of enhanced utility, accounting, performance measurement, or providing troubleshooting aids, etc. It is understood that all such variations are within the scope of the present disclosure.

Also, any code or application described herein, including the network page generation application **115**, the search engine **118**, the electronic commerce application **124**, the search term suggestion engine **121**, the browser **151**, and rendering code **145**, that comprises software or code can be embodied in any non-transitory computer-readable medium for use by or in connection with an instruction execution system such as, for example, a processor **603**, **703** in a computer system or other system. In this sense, the code may comprise, for example, statements including instructions and declarations that can be fetched from the computer-readable medium and executed by the instruction execution system. In the context of the present disclosure, a "computer-readable medium" can be any medium that can contain, store, or maintain the code or application described herein for use by or in connection with the instruction execution system. The computer-readable medium can comprise any one of many physical media such as, for example, magnetic, optical, or semiconductor media. More specific examples of a suitable computer-readable medium would include, but are not limited to, magnetic tapes, magnetic floppy diskettes, magnetic hard drives, memory cards, solid-state drives, USB flash

drives, or optical discs. Also, the computer-readable medium may be a random access memory (RAM) including, for example, static random access memory (SRAM) and dynamic random access memory (DRAM), or magnetic random access memory (MRAM). In addition, the computer-readable medium may be a read-only memory (ROM), a programmable read-only memory (PROM), an erasable programmable read-only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM), or other type of memory device.

It should be emphasized that the above-described embodiments of the present disclosure are merely possible examples of implementations set forth for a clear understanding of the principles of the disclosure. Many variations and modifications may be made to the above-described embodiment(s) without departing substantially from the spirit and principles of the disclosure. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims.

Therefore, the following is claimed:

1. A method, comprising:

capturing, via at least one of one or more computing devices, text as entered into a search query form;

evaluating, via at least one of the one or more computing devices, whether at least one of a plurality of confidence criteria is met based at least in part on a comparison of a plurality of consecutive characters in the text with a plurality of character sequences associated with the at least one of the plurality of confidence criteria and a determination of whether a quantity of characters in the text exceeds a predefined percentage of a first search term suggestion, individual ones of the plurality of confidence criteria being associated with a respective confidence parameter that defines a measurement of confidence in an ability to accurately predict an intended search query, and the predefined percentage being based at least in part on a current search category of a search associated with the text; and

in response to the at least one of the plurality of confidence criteria being met,

providing, via at least one of the one or more computing devices, a speculative search query including a selected suggested search term to a server;

storing, via at least one of the one or more computing devices, a plurality of speculative search results received from the server in response to the speculative search query; and

in response to receiving an instruction to execute a committed search query that includes the selected suggested search term, causing, via at least one of the one or more computing devices, a browser window to be updated by rendering at least a portion of the plurality of speculative search results from a hidden portion of the browser window in a visible portion of the browser window, the hidden portion being separate from the visible portion.

2. The method of claim **1**, wherein the plurality of speculative search results are not displayed in the browser window in response to receiving the plurality of speculative search results.

3. The method of claim **1**, further comprising causing, via at least one of the one or more computing devices, the plurality of speculative search results to be rendered in the hidden portion of the browser window in response to receiving the plurality of speculative search results.

4. The method of claim **1**, wherein evaluating whether the at least one of the plurality of confidence criteria is met is further based at least in part on at least one of whether a number of characters in the text exceeds a predefined threshold.

5. The method of claim **1**, wherein evaluating whether the at least one of the plurality of confidence criteria is met further comprises comparing the text to a specific character defined by the plurality of confidence criteria and indicating that the plurality of confidence criteria are met when the specific character is present in the text.

6. The method of claim **1**, further comprising:

periodically providing, via at least one of the one or more computing devices, the text to the server; and

in response to receiving a plurality of suggested search terms from the server upon providing the text to the server, selecting, via at least one of the one or more computing devices, a suggested search term from the plurality of suggested search terms to produce the selected suggested search term.

7. The method of claim **6**, further comprising:

causing, via at least one of the one or more computing devices, the selected suggested search term to be displayed.

8. The method of claim **7**, further comprising providing, via at least one of the one or more computing devices, the speculative search query to the server prior to receiving the instruction to execute the search query including the selected suggested search term.

9. The method of claim **8**, further comprising causing, via at least one of the one or more computing devices, a remaining portion of the plurality of speculative search results from the speculative search query to be rendered in the visible portion of the browser window in response to receiving the remaining portion of the plurality of speculative search results from the speculative search query.

10. The method of claim **1**, wherein the plurality of confidence criteria are based at least in part on user behavior data associated with a specific user account.

11. A system, comprising:

at least one computing device comprising a processor and a memory; and

at least one application executable in the at least one computing device, wherein, when executed, the at least one application causes the at least one computing device to at least:

monitor a text entry to capture a plurality of characters entered by a user into a search query form;

evaluate whether at least one confidence criterion is met by at least comparing at least two consecutive characters of the plurality of characters with a plurality of character sequences associated with the at least one confidence criterion and determining whether a quantity of characters in the text exceeds a predefined percentage of a first search term suggestion, the at least one confidence criterion being associated with a confidence parameter that defines a measurement of confidence in an ability to accurately predict an intended search query, and the predefined percentage being based at least in part on a current search category of a search associated with the text entry;

provide a speculative search query, including a selected suggested search term, to a server, in response to an indication that the at least one confidence criterion is met;

render a plurality of speculative search results received from the server in a hidden portion of a browser window, wherein the browser window comprises the hid-

den portion and a visible portion, the visible portion being separate from the hidden portion; and

update the browser window by rendering at least a portion of the plurality of speculative search results from the hidden portion of the browser window in the visible portion of the browser window, in response to receiving an instruction to execute a committed search query that includes the selected suggested search term.

12. The system of claim **11**, wherein evaluating whether the at least one confidence criterion is met further comprises determining whether a number of characters in the text entry exceeds a predefined threshold.

13. The system of claim **11**, wherein evaluating whether the at least one confidence criterion is met further comprises:

comparing the text entry to a specific character defined by the at least one confidence criterion; and

indicating that the at least one confidence criterion is met when the specific character is present in the text entry.

14. The system of claim **11**, wherein, when executed, the at least one application further causes the at least one computing device to at least:

display the selected suggested search term to the user.

15. The system of claim **11**, wherein, when executed, the at least one application further causes the at least one computing device to at least:

provide the speculative search query before receiving the instruction to execute the committed search query including the selected suggested search term.

16. The system of claim **11**, wherein, when executed, the at least one application further causes the at least one computing device to at least:

request a remaining portion of the plurality of speculative search results; and

render the remaining portion of the plurality of speculative search results from the speculative search query in the visible portion of the browser window in response to receiving the remaining portion of the plurality of speculative search results from the speculative search query.

17. The system of claim **11**, wherein evaluating whether the at least one confidence criterion is met further comprises evaluating a size of the text entry.

18. A non-transitory computer-readable medium embodying a program executable in a computing device, wherein, when executed, the program causes the computing device to at least:

capture a text entry;

periodically provide the text entry to a server;

determine that at least one of a plurality of confidence criteria is met by comparing at least two consecutive characters in the text entry with a plurality of character sequences associated with the at least one of the plurality of confidence criteria and determining that a quantity of characters in the text entry exceeds a predefined percentage of a first search term suggestion, individual ones of the plurality of confidence criteria being associated with a respective confidence parameter that defines a measurement of confidence in an ability to accurately predict an intended search query, and the predefined percentage being based at least in part on a current search category of a search associated with the text entry;

identify a selected suggested search term selected from a plurality of suggested search terms that are received from the server in response to providing the text entry;

provide a speculative search query, including the selected suggested search term, to the server, in response to an indication that the at least one of the plurality of confidence criteria is met;

store a plurality of speculative search results in response to receiving the plurality of speculative search results based at least in part on the speculative search query;

render the plurality of speculative search results in a hidden portion of a user interface before receiving an instruction to execute a committed search query that includes the selected suggested search term, the user interface comprising the hidden portion and a visible portion, the visible portion being separate from the hidden portion; and

update the user interface by rendering at least a portion of the plurality of speculative search results from the hidden portion of the user interface in the visible portion of the user interface, in response to receiving the instruction to execute the committed search query that includes the selected suggested search term.

19. The non-transitory computer-readable medium of claim **18**, wherein determining that the at least one of the plurality of confidence criteria is met further comprises:

comparing the text entry to a specific character defined by the plurality of confidence criteria; and

indicating that the at least one of the plurality of confidence criteria is met when the specific character is present in the text entry.

20. The non-transitory computer-readable medium of claim **18**, wherein at least one of the plurality of confidence criteria is based at least in part on user behavior data.

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